



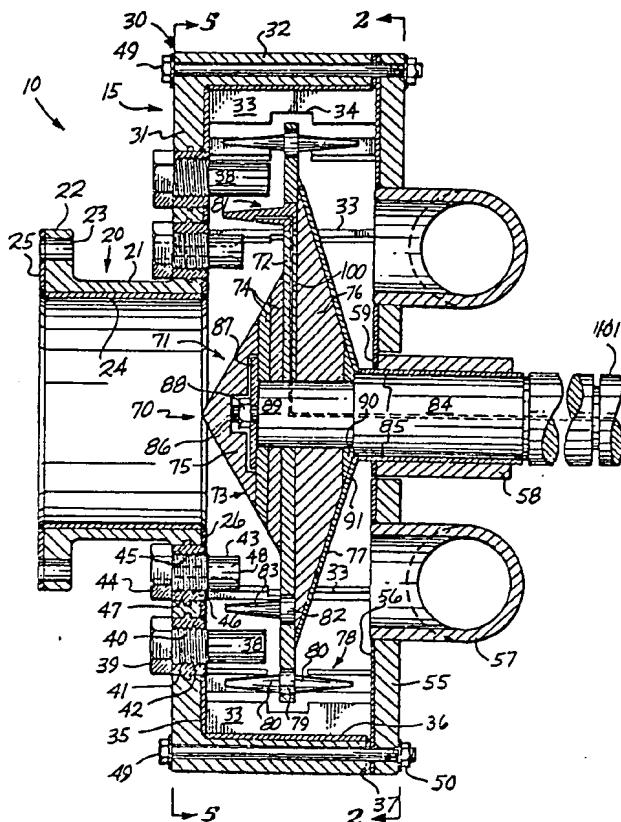
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: DOUBLE SIDED MIXER

(57) Abstract

A double sided mixer promotes efficient and effective chemical bleaching of pulp. In the case of oxygen bleaching, mixing of gas by the transverse motion of rotors (78, 81) through the pulp occurs throughout the mixer (10). A double sided mixer has more rotors per unit volume, and low energy and material requirements.



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DOUBLE SIDED MIXER

BACKGROUND OF THE INVENTION

There are many mixers used with wood pulp. One is described in U.S. Patent 4,303,470. A mixer manufactured by Kamyr is described in "State of the Art Chlorine Dioxide Mixer Installed at Weyerhaeuser," Pulp & Paper, June 1984, pp. 119-121. A mixer is the subject of U.S. Patent 5 4,435,085. We are aware of mixers manufactured by Rauma-Repola of Finland and IMPCO of U.S.A. Advertisements describing the Rauma-Repola mixer are included with this patent application.

SUMMARY OF THE INVENTION

10 The Rauma mixer has an asymmetrical flow and has long pins agitating the pulp. However, better mixing is provided by a symmetrical flow. Further, less power is required when pins are better utilized. The instant invention has a design in which pins are placed on both sides of a rotating plate to obtain greater mixing per unit power and to cause the pulp to exit on the back side of the rotating plate in order to provide uniform and 15 symmetrical flow of the pulp through the mixer.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a cross-sectional view of the mixer.

Figure 2 is a back plan view of the mixer with a portion cut away along line 2-2 of Figure 1.

20 Figures 3 and 4 are isometric views of the rotors, Figure 3 showing a double sided rotor and Figure 4 showing a single sided rotor.

Figure 5 is a front plan view of the mixer with a portion cut away along line 3-3 of Figure 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

25 Referring to Figures 1-5, the mixer 10 has a housing 15 and a rotating member 70. The housing 15 has an inlet pipe 20, a body 30 and a back plate 55 with outlet pipes 57. The inlet 20 is a cylindrical pipe 21 having a collar or flange 22 on its outer end. There are bolt holes 23 in the outer flange 22 for fastening the inlet to a pipe. There is a lining 24 on the 30 cylindrical pipe 21 and an outer lining 25 on the outer face of flange 22 and a lining 26 on the inner edge of the cylinder 21. The linings 24, 25 and 26 are continuous and are composed of SYGEF, a trade name for a highly

crystalline organic-fluoride polymer, to resist corrosion. The cylinder 21 is attached to the body 30. The body has a front plate 31 and side walls 32 forming a bowl. Anti-rotation vanes 33 are spaced around the inner periphery of the side walls 32. Each of the anti-rotation vanes 33 has a 5 central relief 34 to accommodate the rotating member 70. The baffles prevent the rotation of the pulp slurry while it is being mixed by the rotating member. The body members are also lined. There is a lining 35 on the inner face of the front plate 31, a lining 36 on the inner face of the side wall 32 and a lining 37 on the edge of side wall 32.

10 Stators are located on the front plate. There is a cincture of outer stators 38 and a cincture of inner stators 43 surrounding the inlet 20 mounted on the front plate 31. The outer stators 38 have outer heads 39 and attachment threads 40. The stators 38 are threaded into inserts 41 in the front plate 31. The inserts 41 have threads 42 into which the threads 40 of 15 stator 38 are threaded. The inner stators 43 have outer heads 44 and threads 45 and again are inserted into inserts 46 in the front plate 31 which have threads 47. The gas passage 48 extends through the stator 43 for the introduction of gases and liquids into the mixer.

20 An additional gas passage 100 extends through the shaft 84 and the rotating member 70 to a midpoint on the neutral axis of the rotor 81.

25 The body 30 is attached to the back plate 55 by bolts 49 and nuts 50. The back plate 55 also has a lining 56 and a pair of outlets 57 fastened to it. The outlets 57 are preferably elbows. The elbows are shown as being short, but they may extend upwardly above the upper edge of back plate 55.

30 A mechanical seal 58 surrounds the shaft 84 and is sealed to the back plate 55 with an O-ring 59 to prevent pulp fiber from exiting the housing 15.

35 The rotating member 70 has a circular main frame 71 driven by a shaft 84 connected to a motor 101. The shaft 84 narrows to a square stem 89 that supports and translates torque to a brace 90, a back cone 76, a rotor disk 72 and two laminae 74. The brace 90, back cone 76 and rotor disk are attached to the stem 89 by a washer 87 and nut 88 secured to the stem 89 by a stud 86. A front cap 75 is attached to the laminae 74 by welding to form the front cone 73. Thus, the circular main frame 71 has a front cone 73, a rotor disk 72 and a back cone 76 braced against the stem 89 by a brace 90. There is a lining 77 on the back cone 76, a lining 91 on the brace 90 and a

lining 85 on the shaft 84. The linings 77, 91 and 85 are continuous and are also composed of SYGEF.

The rotor disk 72 has a cincture of outer double sided rotors 78 and cincture of inner single sided rotors 81.

5 The inner single sided rotors 81 have a base 82 and an extension 83. The base 82 inserts into the front side of the rotor disk 72 for attachment of the inner rotor to the rotor disk. The inner single sided rotors 81 are placed on the rotor disk 72 to extend between the outer stators 38 and the inner stators 43.

10 The outer double sided rotors 78 have a base 79 and two extensions 80. The base 79 inserts into either side of the rotor disk 72 for attachment of the inner rotor to the rotor disk. The outer double sided rotors 78 are placed on the rotor disk 72 to extend from the front side of the rotor disk to lie between the outer stators 38 and the anti-rotation vanes 33.

15 The rotors 78 also extend from the back side of the rotor disk to lie adjacent to the anti-rotation vanes 33 on the pulp outlet side of the mixer 10.

Wood pulp having a consistency of 1-18% on a dry basis enters the double sided mixer through the inlet pipe 20. The pulp is evenly distributed to the periphery of the mixer by the front cone 73. As the pulp 20 passes to the periphery of the mixer it transversely passes cinctures of rotors and stators where mixing of pulp with fluids, such as gases and liquids, occurs. The effectiveness of mixing is determined by swept area as shown in U.S. Patent 4,303,470. For example, an increase in swept area is obtained by an increase in the length of rotors, travel of rotors and rotation 25 of the rotating member 70. The passage of pulp transverse to the rotors is maintained by anti-rotation vanes 33. The anti-rotation vanes enable the pulp to move radially across the rotating member to obtain maximum swept area per rotor length, travel and rotation speed. After passing axially by the anti-rotation vanes, the pulp transversely passes more rotors and moves 30 radially towards the mixer axis and completes its movement around the rotating member. The pulp is guided towards outlet pipes 57 by a back cone 76 and discharged.

CLAIMS

1. An apparatus for mixing fluids and chemicals with a wood pulp having a consistency of 1-18% comprising,
 - a housing,
 - a pulp inlet attached to said housing,
- 5 a circular disk within said housing having a front and back face wherein said front face is opposite said pulp inlet,
 - means for rotating said circular disk,
 - rotors attached to said front face of said circular disk having an axis extending perpendicular to the direction of rotation, rotors attached to
 - 10 said back face of said circular disk having an axis extending perpendicular to the direction of rotation, and
 - 15 a pair of juxtaposed pulp outlets attached to said housing, said pulp outlets positioned opposite said back face of said circular disk and adjacent to said rotating means, whereby said pulp enters said housing through said pulp inlet, passes transverse to said front face rotors wherein said front face rotors are rotating, travels around said circular disk, passes transverse to said back face rotors wherein said back face rotors are rotating, and leaves said housing through said pulp outlets.
2. A mixer as claimed in claim 1 wherein anti-rotation vanes are attached to said housing.
- 20 3. A mixer as claimed in claim 1 wherein stators are attached to said housing opposite said front face of said circular disk certain of said stators having means for fluid and chemical addition.
4. A mixer as claimed in claim 3 wherein said stators and said rotors are circumferentially located.
- 25 5. A mixer as claimed in claim 1 wherein certain of said rotors have means for fluid and chemical addition.

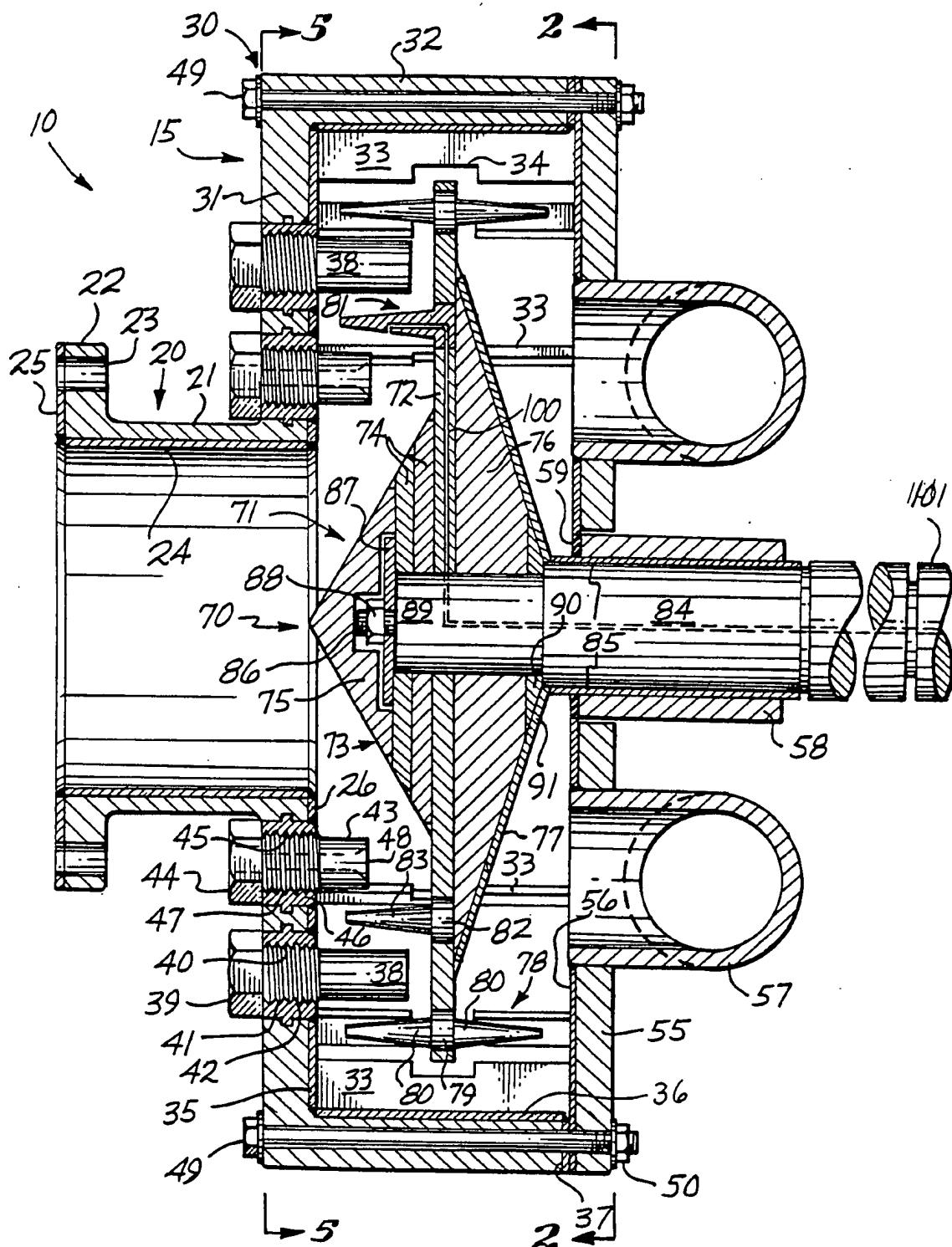
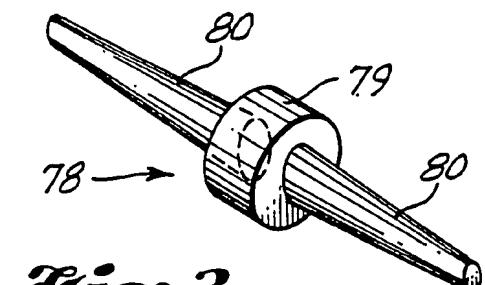
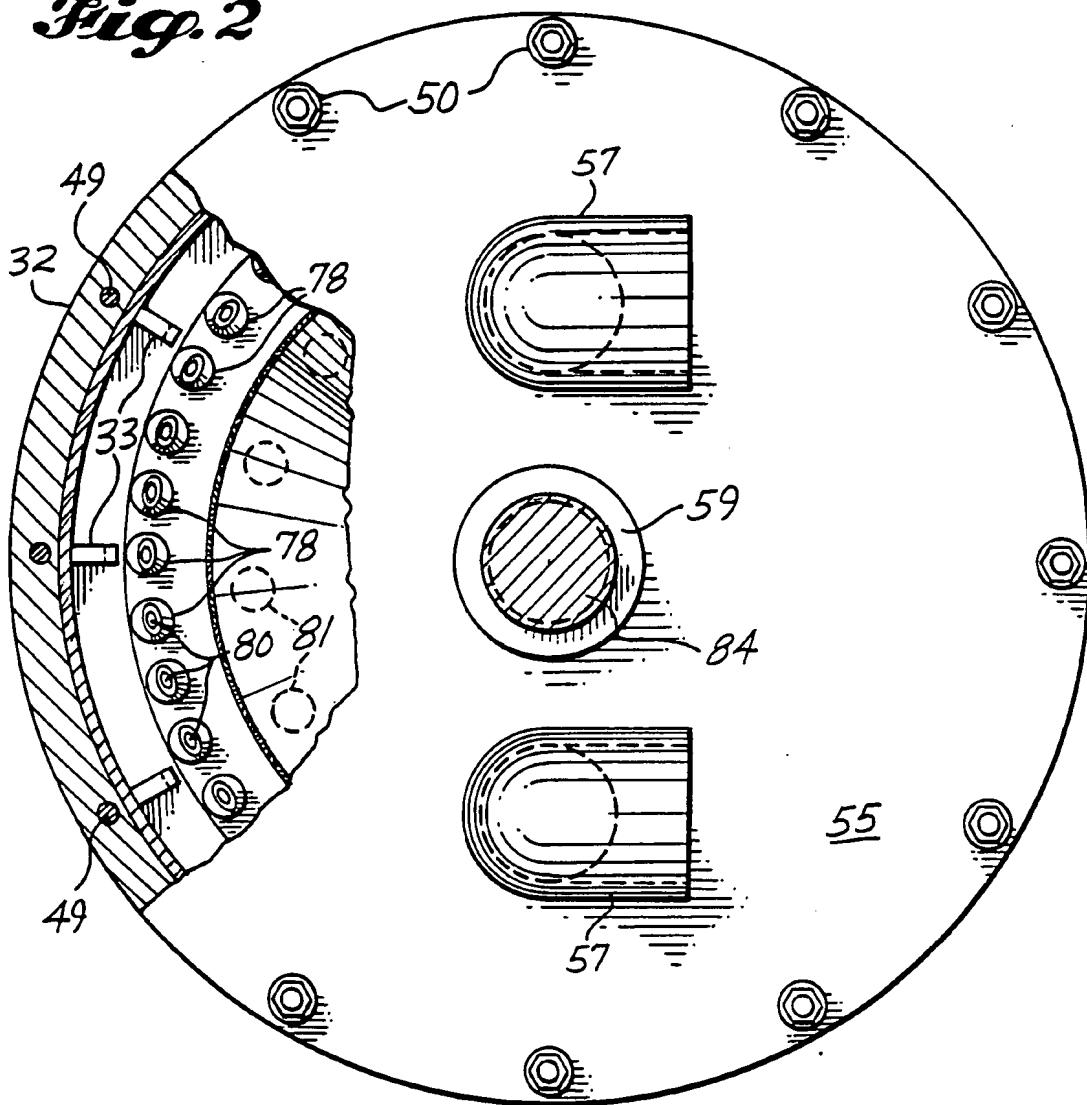
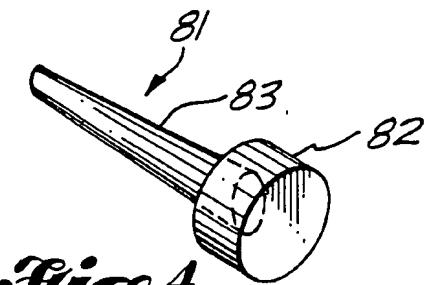
Fig. 1

Fig. 2*Fig. 3**Fig. 4*

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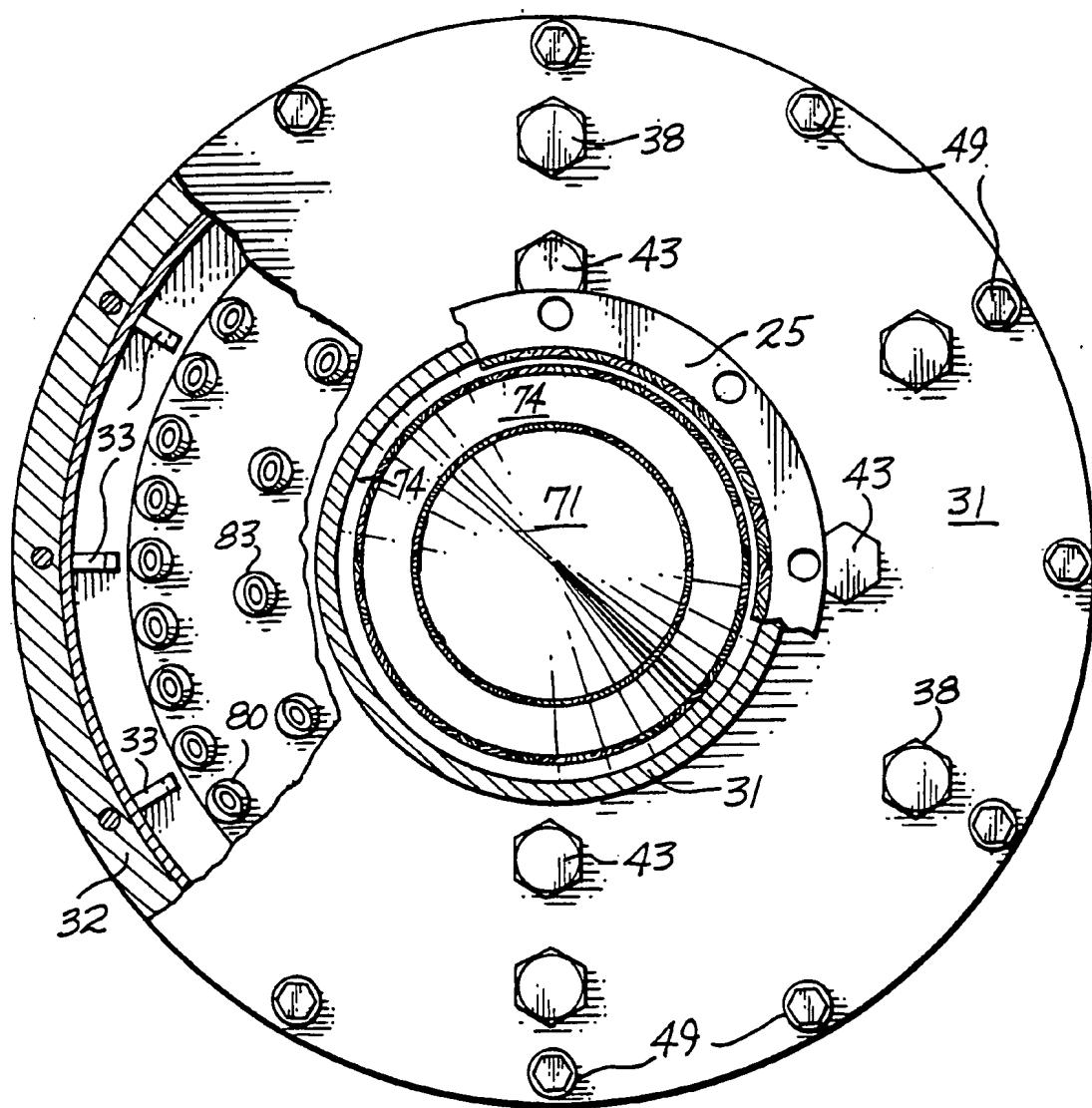


Fig. 5

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US86/00575

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ²

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC(4). B01F 15/02 B01F 15/04 D21C 9/04 D21C 9/10
U.S. C1. 366/155,279,303 162/243

II. FIELDS SEARCHED

Minimum Documentation Searched ⁴

| Classification System | Classification Symbols |
|-----------------------|---|
| U.S. | 366/154,155,176,177,241,262-265,279,302-304,315,317 |
| | 162/57,68,243,246 |
| | 241/28,261.2,261.3 |

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched ⁵

III. DOCUMENTS CONSIDERED TO BE RELEVANT ¹⁴

| Category ⁶ | Citation of Document, ¹⁶ with indication, where appropriate, of the relevant passages ¹⁷ | Relevant to Claim No. ¹⁸ |
|-----------------------|--|-------------------------------------|
| A | US, A, 1,624,037, Published 12 April 1927 (Butler) | 1-5 |
| A | US, A, 1,711,154, Published 30 April 1929 (Michal) | 1-5 |
| A | US, A, 2,441,711, Published 18 May 1948 (McFadden) | 1-5 |
| A | US, A, 4,194,843, Published 25 March 1980 (Martin) | 1-5 |
| A | US, A, 4,283,016, Published 11 August 1981 (Reinhall) | 1-5 |
| A | US, A, 4,435,085, Published 6 March 1984 (Luthi et al) | 1-5 |
| A | US, A, 4,303,470, Published 1 December 1981 (Meredith et al) | 1-5 |
| A | US, A, 4,431,482, Published 14 February 1984 (Heinbockel et al) | 1-5 |

(see second sheet)

* Special categories of cited documents: ¹⁵

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"A" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search ⁹

6 May 1986

Date of Mailing of this International Search Report ⁹

02 JUN 1986

International Searching Authority ¹

ISA/US

Signature of Authorized Officer ¹⁰

Timothy J. Bimone

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

| | | |
|---|--|-----|
| A | US, A, 2,731,253, Published 17 January 1956 (Spencer) | 1-5 |
| A | US, A, 3,081,069, Published 12 March 1963 (Oakes) | 1-5 |

V. OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE¹⁰

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. Claim numbers because they relate to subject matter¹² not required to be searched by this Authority, namely:

2. Claim numbers because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out¹³, specifically:

VI. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING¹¹

This International Searching Authority found multiple inventions in this international application as follows:

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

The additional search fees were accompanied by applicant's protest.

No protest accompanied the payment of additional search fees.